United States Department of the Interior

GEOLOGICAL SURVEY

Water Resources Division
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May 27, 1987

Mr. Wayne Pierre
U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101

Subject: REPORT: USGS comments on: "Ground-water monitoring plan, ICPP Injection Well".

Dear Mr. Pierre:

Transmitted herewith are our comments for the subject report prepared by WINCO dated March 1987. Comments are keyed to the report by section and paragraph number unless otherwise noted.

If there are questions, please contact me at your convenience.

With best regards,

Larry J. Mann

cc: C.E. Clark, DOE-ID
District Chief, USGS, ID-NV

USGS review comments for "Ground-water monitoring plan, ICPP Injection Well"

Section 1:

Par. 2 Releases of radioactive contaminants are more than "several which implies 4 to 9.

Part of the 8 wells currently are not downgradient from the injection well, but are along an equipotential line; when injection took place, however, all were downgradient.

According to our files, no mercury samples were collected at wells 41 to 49, 51, 52, 58, 59 prior to 1983. Mercury may not have been detected because there were no samples collected. In October 1984, however, samples obtained from these wells generally contained <0.1 μg/L of mercury although water from well 41 contained 0.2 μg/L. Suggest discussion be modified to reflect such.

"Since" designates time; should it be "because" owing to a place or condition designation?

Why is the size of the aquifer pertinent? The ten-thousand square-mile area that it underlies is superfluous.

"fast flow of the aquifer"--First, flow usually is a volume whereas velocity is a rate. Second, the aquifer is immobile, although water does move through the basaltic rocks and sediment that combine to form the aquifer.

Who will do the sampling, WINCO or USGS? In either instance, it will take some coordination.

Section 3:

Par. 1 "Many years"--Disposal to the well began in 1952 and ended in 1984; why not state: "From 1952 to 1984,..."?

Section 3.1:

Par. 1 Sentences 2, 3 and 4 are part of the history of the unit and have nothing to do with "well construction" which is the section heading.

Section 5:

Par. 1 For those of us that are not familiar with RCRA jargon, it would help to define "administratively closed". This comment

results from an inquiry made by Frank Sherman of the Idaho Department of Water Resources, State of Idaho.

Attachment 1

Section 1.1.1:

Neocene is antiquated terminology; current usage is Neogene.

Section 1.1.2:

Par. 2
sentence 2 Unconsolidated is misspelled.

Section 1.2.1:

Figure 5 Shows a solid line connecting boreholes and CPP-37 that, at first, appears to be an index for the X-section shown on figure 6. However, it doesn't fit the well locations shown on figure 6. It would help to add well numbers to figure 5 and explain what the solid line means, i.e., is it X-section A-A' for a pipeline or what? Without some sort of index the reader is at a loss to figure out what X-section A-A' represents.

Section 1.3.3:

Par. 3 Mixed tenses are used.

Par. 4 It is doubtful that the 110 foot interbed at RWMC can be correlated with the interbed at the same depth at CFA. The generalized altitude of land surface at the RWMC is about 5,010 feet and near CFA the average altitude is about 4,930 feet. This means the "110-foot bed" would be at an altitude of about 4,900 feet under the RWMC and at about 4,820 feet under the CFA. This is a gradient of about 15 feet/mile to the northeast for the top of the sedimentary bed, or a equivalent basalt flow type, and is comparable to the present-day gradient of the nearby Big Lost River. However, a recent reevaluation of all existing geologic and geophysical data in the TRA-ICPP-CFA area shows that the bed in question is at an altitude of about 4,850 feet under the TRA and ICPP, and this represents a gradient of about 10 feet/mile to the south-southwest. If projected toward the RWMC this oppositely dipping sedimentary bed would occur at an altitude of about 4,760 feet and at a depth of 250 feet below the RWMC. This indicates the 110-foot interbed underlying the CFA may correlate to RWMC's 240-foot interbed.

Section 1.4:

Par. 1 — For consistency, suggest lithologic terminology used here and in par. 1 of section 1.2 be the same.

Section 2:

Par. 1 — By definition a playa is a lake.

Streamflow and pond infiltration are also key sources of recharge.

Six-foot water-level rises are not uncommon; the maximum is more than twice that amount.

Last two sentences are not wholly true in that they ignore the studies at RWMC.

Section 2.1.2:

Par 2 — A maximum is about 900 cfs; the values shown are a range and not a maximum.

In addition to the diversions, 1977-79 was also a period of extremely low runoff. For example, flow in the Big Lost River near Arco was about 25 percent of normal.

Should "Since 1982" actually be "Since 1981"? Otherwise, 1982 is not included in the discussion. It might also be appropriate to point out that most years since 1981 have been above normal runoff.

Section 2.1.3:

Par. 2 — "evapotranspirated" or "evapotranspired"?

Sentences 2 and 3 lead one to the conclusion that the soil underwent a soil-moisture increase of 3.5 percent. If we assume that the trend was prevalent prior to and after 1951-65, then at some point in time the soil is saturated. Is there further discussion needed here?

Section 2.1.4:

Par. 3 — "Varies" implies a change with time; "ranges" would imply a spatial change.

Par. 4, last sentence — Transmissivity divided by thickness equals hydraulic conductivity, not permeability.

The computed velocity of 11 feet/day is the actual velocity of the water as it moves through the aquifer. It was computed as a function of porosity and represents the velocity of water as it follows a sinuous course through the aquifer material. The ground water flow rates of 11 to 20 feet/day was computed on the basis of the arrival time of tritium at a point a known distance downgradient from the disposal site. These velocities are, therefore, Darcian velocities and cannot be compared with the actual velocity because porosity is not a variable in equation used in the computation. The actual velocity, Va, is equal to the Darcian velocity, Vd, divided by the porosity, p; or

$$Va = Vd/p.$$

Thus, the actual velocity of the water would be an order of magnitude greater than the Darcian velocity. Therefore, the computed actual velocity of 11 feet/day must be compared to a velocity of 110 to 200 feet/day calculated using the Darcian velocity as defined by tritium arrival times. Oh, by the way, 11 to 20 feet/day velocities are in Barraclough et al., 1967(b) which is not in reference list.

Section 2.1.5:

Par. 1 sentence 3 — Suggest sentence be modified to read: There may be no continuity in water movement in the basalt flows and breccia zones under unsaturated conditions. The rationale for the suggested change is as follows:

1. Original statement not applicable to sedimentary interbeds; and
2. In places where basalts are overlain by sediment, sediment will store and transmit water to underlying basalt.

Section 2.1.5:

Par. 4 — Figure 13 is not from Thomas, et al. (1986) but from Robertson, et al. (1974). Also, why show a perched-water cross section of the TRA when a similar figure from the ICPP is available? The Thomas, et al. (1986) figures are immediately adjacent and in addition the ICPP figure shows downward water movement (see figure 16).

Section 2.2.3:

Par. 1 — Should the "two layers" concept be modified to a "two conditions" concept? First, there is no assurance that the sediment bed at about 150 feet in the TRA-CPP area is equivalent to the 110 foot interbed at RWMC. Second, neutron logs in some wells near CPP suggest multiple perched ground-water zones. Third, when one considers the sediment at about 150 feet and the underlying basalt, the conditions are not that much different than those described for the surficial

deposits and the basalts that immediately underlie them. That is, in either case, the cross-sectional area available for flow decreases greatly at the sediment-basalt interface.

Par. 2 — The disposal well was not abandoned; it is used as an emergency backup if the pumps to the ponds fail.

Par. 3 — In section 2.1.3, recharge from the infiltration of precipitation was estimated to be 0 to 3.5 percent of the precipitation depending on how the discussion is interpreted. Here, 10 percent of the precipitation is assumed to recharge the aquifer. Does there need to be another sentence or two to justify the difference in numbers?

Given that perched-water zones are developing under the CPP disposal ponds--similar to those at TRA--the question arises: How does the perched-water zones affect solute transport? I have not reviewed or read Thomas et al., 1986, but given the discussion contained herein, I get the impression that only unsaturated flow was considered.

Figure 18 — Vertical scale typo (Cl/ml).

5th sentence — Suggest selenium isotope be specified, i.e., selenium-79, here and elsewhere in paragraph.

7th sentence — The "estimated transit time" versus "transit time".

Would it be helpful to mention that the depth to water is about 450 feet or 140 meters? It is implied on figure 12 but is in meters versus feet which has been the customary unit thus far.

Section 2.3:

Title — Should this section be entitled "hydraulic properties"; most of those listed in Par. 1 are hydraulic versus hydrologic properties. Same goes for discussion in section 2.3.2.

Section 2.3.1:

Par. 1 — Where there are sediment beds in the aquifer, the sediment is porous and may be the chief control for storage.

Par. 3 — Good point in last sentence.

Section 2.3.2:

Table 8 — There is an inconsistency in the references shown on table and those in Section 4.

How was the log (Kv) computed and what is its significance?

Porosity and moisture do not appear to be in percent as stated in column headings.

Saturation in percent is shown to four significant figures when the parameters used to calculate it are shown to two significant figures. Why?

Some Kv's are shown to four or five significant figures. This implies a precision and accuracy that is not obtainable in the field or laboratory.

Section 2.4:

Par. 2 — Recharge is now estimated to be 5 percent of precipitation; compare to previous estimates.

Perched-water zones may not be expected, but in areas at INEL where there is considerable sediment intercalated with the basalt they seem to be the rule rather than the exception.

The 100 year residence time for water in the unsaturated zone may be erroneous. In section 2.2.3, the transit time of Se-79 was 100 years with no retardation and no perched-water zones. An average precipitation must have been used in the projections; an unusually wet year(s) or a perched water zone may greatly affect the accuracy of the estimated residence time.

Par. 3, last sentence — Suggest sentence be modified to read "The vertical gradient..." versus "The gradient..."

There may be one (or more) perched-water zones that underlie the LDU which technically could be an aquifer (or aquifers).

Section 3:

Par. 1 — "hydrogeologic" versus "hydrogeolgic"

Section 3.1:

Par. 1 sentence 3 — Rather than only those above the 110-foot level, other sediment in the basalt sequence from 0-450 feet below land surface may be equally important.

Par. 3 — Although the wireline method did not work well at the RWMC, it was adequate at nine holes drilled in the TRA-CPP area.

Is Shelly tube the drive tube type or split spoon? Drive tube would work the best in sediment.

Section 3.2:

Par. 1 Water-level recorders will not determine the direction of flow.

Are matrix potential and matric potential the same thing? Matrix potential is used in this paragraph.

Section 4:

A reference cited several times in the text and on figures, Lewis and Goldstein (1982), is not included in the reference list.

Also appendix A references USGS OFR 84-231 (1984), Chase and others (1964), and Keys (1963) are not included in list.

Appears to be a typo in second reference, i.e., 1976 versus 1974.